EVOLUTION OF GALAXIES IN CLUSTERS: SEMI-ANALYTIC MODELS AND OBSERVATIONS

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Abstract We present two different projects. The first one is related to the development of a semi-analytic model to follow the formation, the evolution and chemical enrichment of cluster galaxies in a hierarchical dark matter model. The second project concerns the comparison between high resolution N-body simulations of clusters of galaxies with the EDisCS observational dataset.

Keywords: intergalactic medium, galaxy cluster, galaxy formation, galaxy evolution

1. The simulations

We use collisionless simulations of clusters of galaxies generated using the technique of "zooming-in" (Tormen et al., 1997). A suite of cluster simulations covering a wide range of masses and structural properties has been carried out by Barbara Lanzoni as part of her Ph.D. thesis (Lanzoni et al., 2002).

2. The model

The model we use is based on the semi-analytic model presented by Springel et al. (2001) with new prescriptions for the chemical enrichment and the transfer of mass and metals between the different phases. The use of simple physical prescriptions for the transport of metals in the different phases and the choice of a few, physically motivated, parameters allow us to reproduce the relation between stellar mass and metallicity inferred from new SDSS data as well as the observed amount of metals in the ICM. The good agreement between the model predictions and the observational data shows that the circulation of metals between the different baryonic components of the cluster is being well tracked.

Our analysis shows that the chemical pollution of the ICM occurs at relatively high redshift: ~ 80 per cent of the metals today present in the ICM were ejected at redshifts larger than 1. Massive galaxies are important contributors

to the chemical enrichment of the ICM: ~ 75 per cent of the metals today in the ICM were ejected by galaxies with mass larger than $10^{10}\,\mathrm{M}_{\odot}$.

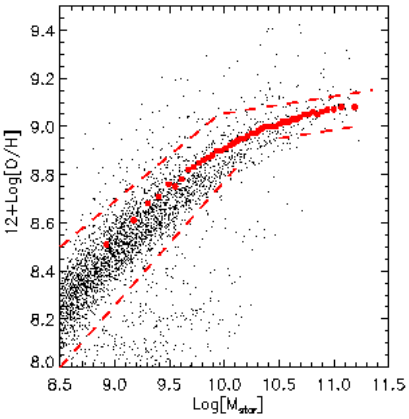

Figure 1. Cold phase metallicity as a function of the stellar mass for model galaxies (points) compared with the results from a sample of $\sim$ 20000 galaxies from the SDSS (Tremonti et al., in preparation).

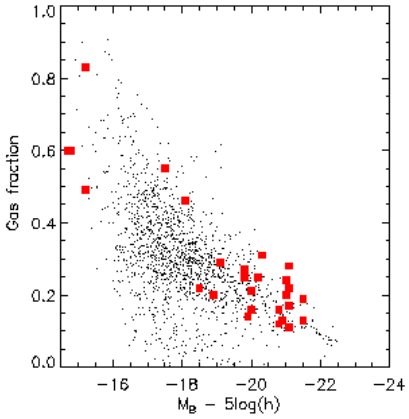

Figure 2. Gas fraction as a function of the B–band luminosity compared with data from Garnett (2002).

3. The observations

The ESO Distant Cluster Survey (EDisCS) is an ESO Large Programme aiming at studying the evolution of cluster population over more that 50 per cent of cosmic time by combining photometric and spectroscopic information on a large sample of clusters at redshift ~ 0.5 and ~ 0.8 with existing information on well studied nearby clusters.

We can compare our simulations to the data to study how the efficiency and relative importance of processes such as quiescent and interaction-driven star formation, ram-pressure stripping, harassment, strangulation and merging, affect the observable structure and stellar populations of cluster galaxies.

References

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